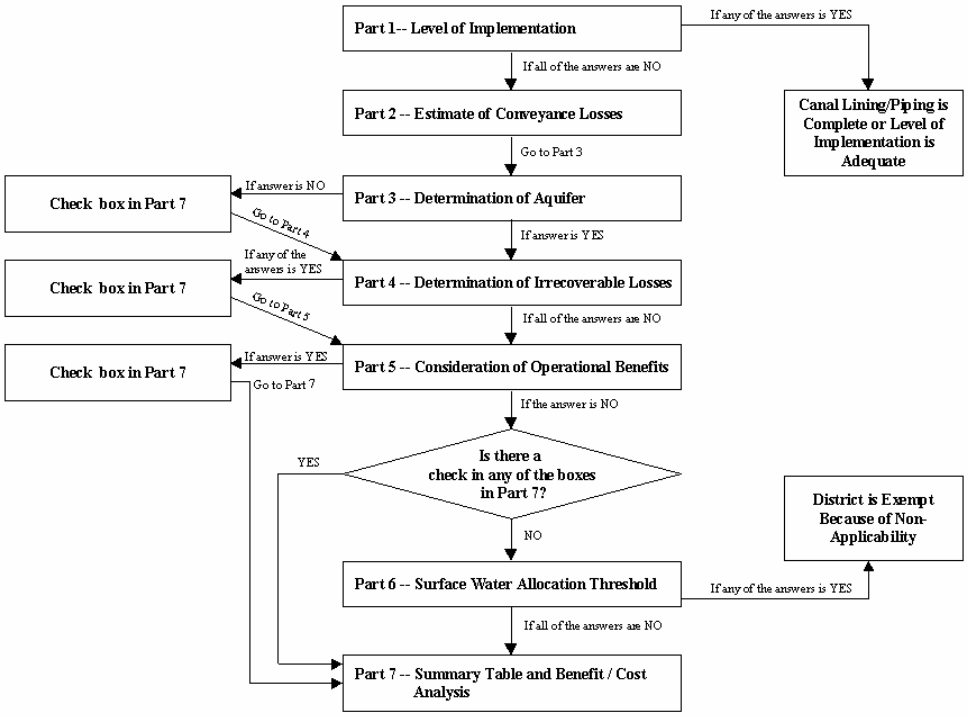
Methodology for Determining Applicability/Implementation of Reservoir Lining

April 2000

Methodology Flowchart

Methodology for Determining Applicability/Implementation of the Canal Lining/Piping



Methodology for Determining Applicability/Implementation of Reservoir Lining

April 2000

Methodology for Determining Applicability/Implementation of Reservoir Lining

---

The purpose of this methodology is to provide a streamlined analytical process for determining the applicability and potential implementation of the reservoir lining as part of *Lining/Piping* best management practice (BMP) for Central Valley Project (CVP) districts. The U.S. Bureau of Reclamation's (Reclamation) criteria for CVP Water Management Plans requires the consideration of lining unlined reservoirs.

This methodology provides a streamlined analytical method for balancing the needs of CVP conjunctive use districts while giving due consideration to the reservoir lining. This methodology has been developed to facilitate the evaluation of the reservoir lining by the district and Reclamation's review, but there may be cases where additional information may be requested. This methodology provides one method of addressing the reservoir lining and does not invalidate or eliminate other acceptable methods.

PART 1 Level of Implementation

YES NO *Is the district's regulating system already fully lined?*

[If the district's regulating system is already fully lined, this in itself is sufficient to justify this element of the *Lining/Piping* BMP as being fully implemented. Lined reservoirs which have aged or been damaged beyond their intended purpose should be considered equivalent to unlined reservoirs. Supporting information should include a statement declaring that the district's regulating reservoirs already fully lined and in good repair.]

YES NO *Does the district already have on-going reservoir lining program?*

[If the district has already implemented a reservoir lining program, the district is already in compliance with requirements of this element of *Lining/Piping* BMP. Supporting information should include a description of the program that has been implemented, the expected timeline of the program, and the estimated district costs]

YES NO *Is the district's conveyance system fully piped and does the district experience very infrequent to no operational spills? (Reservoirs were constructed for and are used principally for groundwater recharge purposes.)*

[Many fully piped distribution systems do not require the use of a regulating reservoir except for infrequent use or under non-typical conditions. A groundwater recharge reservoir might be used during the low demand winter season to reverse flow water using gravity. Demands may be such that pumping costs could be substantially reduced by the use of an up-slope recharge basin to store water and reverse flow to meet irrigation demands. Recharge reservoirs may also be used to store water during a non-routine shutdown or de-watering of a main source canal.]

YES NO *Has the district evaluated soil conditions at reservoir sites and determined that the natural soil permeability is adequate to minimize seepage?*

[Some soil types naturally have low coefficients of permeability which minimize water seepage. If the district evaluated the soil conditions at the reservoir sites and it was determined that the soil's permeability was low enough to minimize the seepage, this portion of the lining/piping BMP is considered to be adequately implemented. Supporting information must include the coefficient of permeability, an estimate of total annual seepage, and a simple benefit/cost analysis or statement to support the conclusion.]

If any of the answers above are YES, provide supporting information. No further analysis of this methodology is required. The implementation of this BMP is complete or ongoing. If the district is currently implementing a reservoir lining program, then the program is considered ongoing at an adequate level of implementation and reporting will be required in the annual update reports.

If all of the answers above are NO, then go to Part 2.

PART 2 Estimate of Seepage

Table 1: Summary of Reservoir Losses.

Reservoir Type	Quantity (each)	Total Area (acres)	Estimated Total Seepage (AF/YR)
Unlined Reservoirs			
Lined Reservoirs			
Other:			

NOTE: Lined reservoirs that have aged or been damaged beyond their intended purpose should be considered equivalent to "unlined reservoirs" and listed under "Other:"

Table 2: Summary of Seepage Recovery.

Reservoir Type	Estimated Seepage Recovered (AF/YR)	Estimated Seepage Lost to Service Area (AF/YR)	Estimated Seepage Lost to Saline Sink (AF/YR)
Unlined Reservoirs			
Lined Reservoirs			
Other:			

[The intent of these tables is to take an inventory of the district's reservoir facilities and determine the magnitude of estimated seepage. Pumping records, water input/output records, analyzing soil types, and/or performing field tests can be used to estimate reservoir seepage.]

Go to Part 3.

PART 3 Determination of Aquifer

YES NO *Is the district in an area with usable groundwater from an unconfined aquifer?*

[Districts with conjunctive use or groundwater recharge programs typically overlie an unconfined aquifer. Reservoir seepage in areas without unconfined aquifers with usable groundwater are typically irrecoverable and/or create adverse impacts. The pumping of groundwater and/or recovery of percolated water must also be economically feasible for seepage to be recoverable and conjunctive use to be practicable. Supporting aquifer information may be available from studies and

reports produced by the USBR, Natural Resources Conservation Service, California Department of Water Resources, and/or other engineering projects.]

If YES, provide supporting information and go to Part 4.
If NO, place a check in the box in Part 7 and go to Part 4.

PART 4 Determination of Irrecoverable Seepage

YES NO *Does seepage from regulating reservoirs contribute to a subsurface drainage problem or become lost to a saline sink?*

[Reservoir seepage which contributes to subsurface drainage problems or is lost to a saline sink, creates irrecoverable losses and negative impacts. The extent and cost of the irrecoverable reservoir seepage and the negative impacts generated must be considered and analyzed.]

If YES, place a check in the box in Part 7 and go to Part 5.
If NO, provide supporting information and go to Part 5.

PART 5 Consideration of Operational Constraints

YES NO *Would operational and/or delivery constraints in the district's service area with unlined reservoirs be improved as a result of reduced reservoir seepage?*

[There may be areas within the district that are operationally constrained during the peak irrigation period and may realize benefits from reduced reservoir seepage losses. A survey of ditch tenders and waters users will assist in answering or justifying the response to this question. The operations supervisor or water master should also be questioned about the frequency and extent of water orders that must be prorated during peak demand periods. Water orders prorated because of demands in excess of system design capacities should not be considered as negatively impacted by reservoir seepage.]

If the answer above is YES, place a check in the box in Part 7 and go to Part 7.
If the answer above is NO and there is a check in any of the boxes in Part 7, go to Part 7.
If the answer above is NO and there are no checks in any of the boxes in Part 7, provide supporting information and go to Part 6.

PART 6 Surface Water Allocation and Allowable Thresholds and Programs

YES NO *Is the district's non-storable water supply to firm water supply contract ratio 2.5:1 or greater <u>and</u> are the regulating reservoirs also used for groundwater recharge?*

[Firm surface water is typically one that is reliable and storable. A ratio of 2.5:1 or greater of the district's non-storable to firm water supply contract quantities indicates that the firm surface water supply represents less than 30% of crop irrigation needs. If the firm surface water supply represents less than 30% of crop irrigation needs, this indicates that additional non-storable surface water or groundwater would be needed to meet over 70% of the crop irrigation needs. This type of water supply ratio between the firm district supply and the other water supplies indicates that the district is a conjunctive use district and the water users rely on the ability to recharge and extract groundwater within the service area. The district's ability to recharge the groundwater reservoir plays an important role in the conjunctive use program.]

YES NO *Does the total seepage loss from the district's regulating reservoirs represent less than 2% of the district's average annual surface water supply?*

[A minimal amount of reservoir seepage losses is always expected. The quantity of losses will depend on the type of lining, depth of water, and the length of time that water resides in the reservoir. If operations and conditions are such that reservoir seepage accounts for only 2% or less of the district's annual surface water supply, seepage losses can be considered minimal and insignificant.]

YES NO *Are the reservoirs that are used for regulating operations also used as groundwater recharge basins and, if so, at least 90% of the time for recharges purposes?*

[The intended use of the reservoir must be considered. If a reservoir is used at least 90% of the time for groundwater recharge purposes, the use of this reservoir for regulating or other purposes can be considered secondary. Since the reservoir was constructed for groundwater recharge purposes, the seepage that results from the incidental uses, can be considered minimal and insignificant.]

YES NO *Does reservoir seepage to the groundwater basin benefit other participants in a joint groundwater management program <u>and</u> is the reservoir seepage given due consideration or is the district compensated by the other participants for providing this joint benefit?*

[Some districts may have prearranged groundwater recharge programs with neighboring districts. These programs incorporate the benefits realized by neighboring districts from the groundwater recharge programs and the district is

compensated for providing this benefit. These programs take into consideration that the groundwater basin is essentially boundary-less and share in the use of the facilities and management of the resources. Supporting information must include a description of the arrangement between participating districts.]

If any of the answers above are YES, provide supporting information. District is exempt from the implementation of this BMP because of non-applicability.

If all of the answers above are NO, go to Part 7.

PART 7 Summary Table and Benefit/Cost Analysis

Summary Table:

☐ Part 3: Majority of district does not overlie an unconfined aquifer or the groundwater is too deep to be economically extracted.

☐ Part 4: Seepage losses contribute to a salt sink or are lost from district boundary.

☐ Part 5: Operational constraints exist as a result of reservoir seepage losses.

.....

Benefit/Cost Analysis:

Perform a benefit/cost analysis, which includes the items that were identified and summarized above as warranting further consideration for the implementation of the reservoir lining best management practice. The reservoirs with the most potential for improvement should be identified and analyzed. Perform analysis in accordance with:

A. Methodology included in the Agricultural Water Management Council (AB3616) process (Attachment 1); or

B. Accepted engineering methods. The analysis should, at a minimum, include:

1. A description of the project(s) that would be required;

2. Listing of the work or materials required with estimated quantities and prices;

3. Estimated engineering, surveying and administrative costs;

4. Estimated contingency costs;

5. Total project costs annualized over the life of the improvements;

6. Estimated increases/decreases in maintenance costs;

7. Estimated cost of irrecoverable conveyance seepage and/or costs associated with exacerbation of drainage and salinity problems, if any;

8. Estimated benefits to operational constraints, if any;

9. Estimated benefits of reduced district groundwater pumping costs, if any; and

10. Estimated cost of conserved water per project on a per acre-foot basis.

Attachment 1

EXHIBIT E

NET BENEFIT ANALYSIS

FOR

EFFICIENT WATER MANAGEMENT PRACTICES

BY AGRICULTURAL WATER SUPPLIERS

AB 3616 Water Management Act of 1990

November 13, 1996

AS MODIFIED FOR

METHODOLOGY FOR DETERMINATING
APPLICABILITY/IMPLEMENTATION
OF RESERVOIR LINING

April 2000

TABLE OF CONTENTS

BMP: Line Reservoirs

PART 3

General Information for Detailed Analysis

Part 3 provides general information for reservoir lining.

A. Does reservoir lining impact any of the other BMPs?

____Yes ____No

If Yes, Discuss the expected impacts.

If No, Continue.

B. Complete the following matrix. Additionally, attach a description of how seepage flows were determined (e.g., consultant report, field study, water budget).

Estimated area of reservoirs in service area (acres)	
Reservoirs currently unlined (acres)	
Reservoirs currently lined (acres)	
Potential average seepage flows from unlined reservoirs (ac-ft/yr)	
Potential average recovered seepage flows from unlined reservoirs (ac-ft/yr)	
Estimated average seepage flows which exit and are lost to service area (ac-ft/yr)	
Estimated average seepage flows which exit and are lost to the basin (ac-ft/yr)	
Estimated average seepage flows which exit and are lost to the saline sink (ac-ft/yr)	

C. Was reservoir lining considered in coordination with any other BMPs or other neighboring water suppliers?

____Yes ____No

If Yes, Describe the proposal(s) and continue.

If No, Describe the project(s) to be evaluated and continue.

PART 4

Environmental, Third Party, and Indirect Economic Analysis

Part 4 addresses potential environmental, third party, and indirect economic impacts for reservoir lining.

NOTE: For the following sections, any indeterminate effects on the environment or third parties may require further study.

The intent of this process is to be broad enough to encompass most scenarios that would exist in all water supplier service areas. However, if your interpretation of any potential effect for the following questions differs from the one stated, please feel free to attach an explanation for that particular question.

ENVIRONMENTAL EFFECTS

A. Source of Supply

Will implementation of reservoir lining result in reduced water demand in the water supplier's service area?
____Yes ____No ____Unknown

If Yes, There may be a potential beneficial/negative impact, check the appropriate column on the Potential Environmental Effects Summary, Table 1, and attach a description of the intended use of the water (e.g. stored in reservoir, instream flows, etc.)

If No, Check Insignificant on Table 1, Potential Environmental Effects Summary.

If Unknown, Check Indeterminate on the Potential Environmental Effects Summary Table 1.

B. Confined/Unconfined Ground Water Levels

Are there any habitats in the water service area that are supported/supplied by existing groundwater levels?
____Yes ____No ____Unknown

If No, Check Insignificant on Table 1. Attach a description explaining why implementation will not result in reduced diversions.

If Unknown, Check Indeterminate.

If Yes, Will implementation of reservoir lining affect the groundwater levels?
____Yes ____No ____Neither ____Unknown

If Yes, Check appropriate column on Table 1. Include a description of the habitat, and how the habitat would be impacted by changes in the groundwater levels.

If No or Neither, Check Insignificant on Table 1. Please attach a description of the habitat and estimated increased supply.

If Unknown, Check Indeterminate on Table 1.

C. Shallow Groundwater

Is the water supplier located in an area where shallow groundwater and/or water quality problems (i.e., salinity, selenium) limit the use of land and/or drainage water?
____Yes ____No ____Unknown

If Yes, Do you anticipate that shallow groundwater conditions will improve or degrade as a result of implementation of reservoir lining?
____Improve ____ Degrade ____Neither ____Unknown

If Improve, Improved groundwater conditions should create an overall environmental benefit; check Beneficial. Please attach a description of improved conditions with respect to water levels and quality (in terms of TDS and/or known constituents of concern).

If Degrade, Check Negative. Please attach a description of the expected degraded conditions with respect to water levels and quality (in terms of TDS and/or known constituents of concern).

If Neither, Check Insignificant. Attach a description explaining why shallow groundwater will not be impacted.

If Unknown, Check Indeterminate.

If No, Check Insignificant.

If Unknown, Check Indeterminate.

D. Instream Flows

Does the water supplier's distribution system contribute to flows in any other water courses?
____Yes ____No ____Unknown

If No, Check Insignificant.

If Unknown, Check Indeterminate.

If Yes, Will implementation of reservoir lining affect flows to any other water courses?
___Yes ____ No____ Neither ____Unknown

If Yes, Check appropriate column on Table 1. Include a description of the positive or negative impacts on the flows , and how the habitat would be impacted by changes.

If No or Neither, Check Insignificant on Table 1.

If Unknown, Check Indeterminate on Table 1.

E. Drain Flows

Does the water supplier's service area have drains that supply or support habitat?
____Yes ____No ____Unknown

If No, Check Insignificant.

If Unknown, Check Indeterminate.

If yes, Will these drain flows be reduced as a result of practices associated with reservoir lining?
____Yes ____No ____Unknown

If Yes, there is a potential negative impact; check Negative and include a description on the adverse effects to any habitat.

If Unknown, Check Indeterminate.

If No, Do you anticipate that drain water quality will improve or degrade as a result of implementing reservoir lining?
___Improve ___Degrade ___Neither ___Unknown

If Improve, Improved drain water conditions should create an overall environmental benefit; check beneficial. Please attach a description of improved conditions with respect to quality (in terms of TDS and/or known constituents of concern).

If Degrade, Check Negative. Please attach a description of the expected degraded conditions with respect to quality (in terms of TDS and/or known constituents of concern).

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

F. Fertilizer/Herbicide/Pesticide Use

Are pesticides/herbicides used to control vegetative growth or burrowing along reservoirs?
____Yes ____No

If No, Check Insignificant.

If Yes, Will pesticide/herbicide use by the water supplier along reservoirs be decreased or increased as a result of lining?
____Decrease ____Increase ____Neither ____Unknown

If Neither, Check Insignificant on Table 1.

If Unknown, Check Indeterminate on Table 1.

If Decrease/Increase, There may be a potential impact on the environment. Please check the appropriate column on Table 1 and attach a description of the potential impacts of the increase/decrease in pesticide use.

G. <u>Soil Erosion</u>

Will implementation of reservoir lining reduce the current amount of soil erosion in the water supplier service area?
____Yes ____No ____Unknown

If Unknown, Check indeterminate.

If Yes/No, There may be a potential impact on the environment. Please check the appropriate column on Table 1 and attach a description of the potential impacts of reservoir lining.

H. <u>Field Burning and/or Fugitive Dust</u>

Is vegetation removed from reservoir banks by burning?
____Yes ____No

If No, Check Insignificant.

If Yes, Would this burning decrease as a result of lining reservoirs?
____Yes ____No ____Neither ____Unknown

If Yes/No, There may be a potential impact on the environment. Please check the appropriate column on Table 1 and attach a description of the potential impacts of reservoir lining.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

I. Energy Use

Would reservoir lining increase or decrease energy use (e.g., pump use, canal structure controls, etc.)?
___Decrease ___Increase ___Neither ___Unknown

If Decrease, Less energy consumption and/or lower air emissions would be potential environmental benefits; check beneficial.

If Increase, Check Negative.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

J. Do reservoirs that might be considered for lining supply or support any of the following habitats:

Yes	No	
___	___	Vernal pools and swales
___	___	Riparian
___	___	Open water bodies
___	___	Marshes (permanent or seasonal)

Please attach a description to any "Yes" answers to the previous question. Include in your description any known or potential sensitive plant and wildlife species in the habitat and the approximate size and location of the habitat. If the habitat is a series of smaller parcels (e.g., vernal pools) just describe the general location. Also identify your source of information. Finally, on Table 1 check whether you believe that the potential impact to the habitat would be beneficial, negative, insignificant, or indeterminate; attach a description and justification.

THIRD-PARTY EFFECTS

A. Confined/Unconfined Ground Water Levels

Will implementation of reservoir lining affect groundwater elevations?
____Yes ____No ____Unknown

If Yes, Rise or fall of the groundwater levels could have potential benefit or negatively affect the third-party groundwater users in the basin; check appropriate column on Table 2, Potential Third-Party Effects Summary. Attach a description of the anticipated effect on groundwater levels and third-party users.

If No, Check appropriate column on Table 2. Attach a description as to why you expect groundwater levels to remain unchanged.

If Unknown, Check Indeterminate on Table 2.

B. <u>Instream Flows</u>

Do water supplier distribution flows contribute to any natural streams?
___Yes ___No ___Unknown

If No, Check Insignificant, go to C.

If Unknown, Check Indeterminate.

If yes, Will implementation of reservoir lining decrease or increase instream flows to any streams that supply or support any third-party?
____ Decrease ____ Increase ____ Neither ____ Unknown

If Decrease, There may be a potential negative effect to third-party users; check Negative on Table 2. Include a description of the potential adverse effects on third-party users by reduced instream flows.

If Increase, Creating additional supplies may result in a benefit; check Beneficial. Please attach a description of the potential benefits and estimated increased supply.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

C. <u>Drain Flows</u>

Do drain flows supply or support any third-party user?
____Yes ____No

If Yes, Do you anticipate that drain water conditions will be affected as a result of implementation of reservoir lining?

____Yes ____No ____Unknown

If Yes, Improved or adversely affected drain water may have an overall benefit or detrimental effects to the third parties; check appropriate column on Table 2. Please attach a description of drain water conditions with respect to quality (in terms of TDS and/or known constituents of concern).

If No, Check appropriate column on Table 2. Please attach a description of the expected degraded conditions with respect to quality (in terms of TDS and/or known constituents of concern).

If Unknown, Check Indeterminate.

D. <u>Herbicide/Pesticide Use</u>

Are pesticides/herbicides used to control vegetative growth or burrowing along reservoir system banks?
___Yes ___No

If No, Check Insignificant.

If Yes, Does water that flows through water supplier reservoirs continue on to third-party users (such as M&I)?
____Yes ____No

If No, Check Insignificant.

If Yes, Will fewer pesticides/herbicides be applied by the agricultural water supplier as a result of implementing reservoir lining?
___Yes ___No

If No, Check Insignificant.

If Yes, There may be a potential impact on third parties. Please check the appropriate column on Table 2 and attach a description of the potential impacts of reservoir lining.

E. <u>Wind/Water Soil Erosion</u>

Will implementation of reservoir lining reduce the current amount of soil erosion in the water supplier service area?
____Yes ____No ____Unknown

If Yes, There may be a potential impact on third parties. Please check the appropriate column on the Table 2 and attach a description of the potential impacts of reservoir lining.

If No, Check insignificant.

If Unknown, Check indeterminate.

INDIRECT ECONOMIC EFFECTS

A. Will reservoir lining affect local economies through changes in on-farm operations (indirect economic effects)?

___Yes ___No ___Unknown

If Yes, Please describe.

If No, Check Insignificant on Table 3, Potential Indirect Farm Production Effects Summary, Sections B, C, and D.

If Unknown, Check Indeterminate on Table 3, Sections B, C, and D.

B. Will practices associated with implementation of reservoir lining increase or decrease farmers' purchases of crop inputs such as seed, fertilizer, irrigation equipment, etc.?

___Increase ___Decrease ___Neither ___Unknown

If Increase, There may be a potential benefit; check beneficial on Table 3, Section B.

If Decrease, There may be a potential negative effect; check Negative on Table 3, Section B.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

C. Will practices associated with implementation of reservoir lining increase or decrease the hiring of local (county) farm workers?

___Increase ___Decrease ___Neither ___Unknown

If Increase, There may be a potential benefit; check beneficial on Table 3, Section C.

If Decrease, There may be a potential negative effect; check Negative.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

D. Will practices associated with the implementation of reservoir lining increase or decrease the local (county) processing of farm produce (examples--canning of nuts, fruits, and vegetables; milk production supported by cows/pasture; etc.)?

___Increase ___Decrease ___Neither ___Unknown

If Increase, There may be a potential benefit; check Beneficial on Table 3, Section D.

If Decrease, There is a potential negative effect; check Negative.

If Neither, Check Insignificant.

If Unknown, Check Indeterminate.

Table 1. Potential Environmental Effects Summary

Section	Evaluated Component	Beneficial	Negative	Insignificant	Indeterminate
A	Source of Supply				
B	Confined/Unconfined Groundwater Levels				
C	Shallow Groundwater Elevations				
D	Instream Flows				
E	Drain Flows				
F	Fertilizer/Herbicide/ Pesticide Use				
G	Soil Erosion				
H	Field Burning and Fugitive Dust				
I	Energy Use				
J	Vernal Pools and Swales				
	Riparian Habitat				
	Open Water Bodies				
	Marshes (permanent or seasonal)				

Table 2. Potential Third-Party Effects Summary

Section	Evaluated Component	Beneficial	Negative	Insignificant	Indeterminate
A	Confined/Unconfined Ground Water Levels				
B	Instream Flows				
C	Drain Flows				
D	Herbicide/Pesticide Use				
E	Wind/Water Soil Erosion				

Table 3. Potential Indirect Farm Production Effects Summary

Section	Evaluation Component	Beneficial	Negative	Insignificant	Indeterminate
B	Farm Inputs				
C	Local Farm Labor				
D	Processing of Farm Produce				

PART 5

Reservoir Lining Economic Analysis

Part 5 evaluates the economic benefits and costs of reservoir lining. Worksheets 1 through 4 enable the water supplier to develop a benefit/cost (B/C) ratio for reservoir lining from the water supplier perspective.

Worksheet 1. BMP Water Supplier Effects

. **How much water is estimated to be conserved annually as a result of reservoir lining?**

_____acre-feet

Please discuss your assumptions and methodology for deriving this estimate.

. **Does reservoir lining result in water supplier capital costs and/or annual operation and maintenance costs?**

___Yes ___No ___Unknown

If Yes, Please complete Worksheet 2 and continue.

IF No or Unknown, Please describe.

. **Would reservoir lining reduce current water supplier water purchases, water diversions, and/or groundwater pumping?**

___Yes ___No ___Unknown

If Yes, Please complete Worksheet 3a and continue.

. **Would reservoir lining delay or eliminate the need to complete future water supply augmentation and/or distribution projects?**

___Yes ___No ___Unknown

If Yes, Please complete Worksheet 3b.

. **Would reservoir lining result in additional sales of water supplies to existing customers, new customers, and/or other agencies?**

___Yes ___No ___Unknown

If Yes, Please complete Worksheet 3c.

Worksheet 2. Reservoir Lining Water Supplier Costs

2a. Reservoir Lining Water Supplier Capital Costs

Complete the following worksheet for reservoir lining capital costs:

Capital Cost Category (a)	Item (b)	Cost (c)	Contingency Cost Percent (d)	Contingency Cost Dollars (c x d) (e)	Subtotal (c + e) (f)
Planning			**0.15**		
Land			**0.15**		
Structures			**0.15**		
Equipment			**0.15**		
Mitigation			**0.15**		
Other			**0.15**		
Subtotal Capital Costs					
Deduct Expected Salvage Value After 25 Years					
Total Capital Costs					
Capital Recovery Factor (6%, 25 Years)					**0.0782**
Annual Capital Costs (Total Costs x CRF)					

Enter Annual Capital Costs into Worksheet 2c, Column (a).

2b. Reservoir Lining Water Supplier Annual O&M Costs

Complete the following worksheet for reservoir lining annual O&M costs:

Annual Operating Costs (a)	Annual Maintenance Costs (b)	Annual Other Costs [1] (c)	Total O&M Costs (a + b +c) (d)

[1]Other annual costs not included in O&M, such as annual environmental mitigation costs.

Enter Total O&M Costs into Worksheet 2c, Column (d).

2c. Reservoir lining Water Supplier Costs/AF Summary

Complete the following worksheet for reservoir lining cost/af summary:

Annual Capital Costs[1] (a)	Annual O&M Costs[2] (b)	Total Annual Costs (a + b) (c)	Annual Conserved Water[3] (AF) (d)	Cost/ AF (c/d) (e)

[1]From Worksheet 2a.
[2]From Worksheet 2b.
[3]From Worksheet 1.

Enter the cost/af onto Worksheet 4, BMP Cost**.**

Worksheet 3. Reservoir lining Water Supplier Benefits

Note: The value of the conserved water to the water supplier is determined by how the conserved water is used. If the conserved water allows the water supplier to reduce the amount of water purchased, diverted or pumped, then the value is equal to the avoided cost of obtaining water from the supplier's most expensive current water source. However, if the water supplier needs to augment water supplies to meet future demands, then the value to the water supplier is measured by the least-cost alternative that can be eliminated or delayed because of reservoir lining. Finally, if the water supplier plans to sell all or part of the conserved water to existing customers, new customers or other agencies, then the value can be measured by the price for which it is sold, thus generating additional revenue. Choose the most appropriate method.

3a. Water Supplier Avoided Costs--Current Sources

Complete the following worksheet for current sources of supply that would be avoided with the implementation of reservoir lining:

Sources of Supply Avoided (a)	Amount of Water (af) (b)	Annual O&M Costs ($/af) (c)	Source to be Used as Benefit Measure (d)

Enter the avoided cost ($/af) from the sources selected into Worksheet 4, reservoir lining Benefit**.**

3b. Water Supplier Avoided Costs--Future Sources

Complete the following worksheet for future sources eliminated or delayed because of implementation of reservoir lining:

Alternative (a)	Total Capital Costs (b)	Capital Recovery Factor[1] (c)	Annual Capital Costs (b x c) (d)	Annual O&M Costs (e)	Total Annual Costs (d + e) (f)	Annual Yield (g)	Cost/af (f / g) (h)
		0.0782					
		0.0782					
		0.0782					
		0.0782					

[1]For a 25-year period with 6% discount rate.

Which alternative is to be selected as benefit measure? Explain:

Enter the cost/af value for alternative selected into Worksheet 4, BMP Benefit.

3c. Water Supplier Revenue Effects

Complete the following worksheet:

Parties Purchasing Conserved Water (a)	Amount of Water (af) (b)	Selling Price ($/af) (c)	Expected Frequency of Sales (%)[1] (d)	Expected Selling Price ($/af) (c x d) (e)	"Option" Fee ($/af)[2] (f)	Total Selling Price ($/af) (e + f) (g)

[1]During a 25-year analysis period, how many years are water sales expected to occur? For example, water sales to farmers might be expected to occur 90% of the years, whereas the frequency to other agencies might be 50% of the years.

[2]"Option" fees are paid by a contracting agency to a selling agency to maintain the right of the contracting agency to buy water whenever needed. Although the water may not be purchased every year, the fee is usually paid every year.

Enter the expected selling price (revenue) into Worksheet 4, reservoir lining Benefit.

Worksheet 4. Reservoir lining Water Supplier Benefit/Cost Ratio

Complete the following worksheet:

Benefits and Costs	
Reservoir Lining Benefit ($/af)[1]	
Reservoir Lining Cost ($/af)[2]	
Benefit/Cost Ratio	

[1]From Worksheet 3a, 3b or 3c.

[2]From Worksheet 2.

Part 6

Reservoir Lining Financial Analysis

A water supplier may claim an exemption if:

"Adequate funds (including funds from other beneficiaries of the plan) are not available, and cannot reasonably be expected to be made available, for implementation of reservoir lining during the term of the plan." (MOU, Section 4.02)

If water supplier is claiming an exemption based upon the lack of available funding, please discuss the reasons for this finding. Please include a copy of your latest financial statement and a list of other potential plan beneficiaries who have been contacted.

Part 7

Summary of Analysis

Potential Environmental Effects Summary Table (from Part 4)

Section	Evaluated Component	B	N	I	IN
A	Source of Supply				
B	Confined/Unconfined Groundwater Levels				
C	Shallow Groundwater Elevations				
D	Instream Flows				
E	Drain Flows				
F	Fertilizer/Herbicide/Pesticide Use				
G	Soil Erosion				
H	Field Burning and Fugitive Dust				
I	Energy Use				
J	Vernal Pools or Swales				
	Riparian Habitat				
	Open Water Bodies				
	Marshes (permanent or seasonal)				
TOTALS					

Potential Third-Party Effects Summary Table (from Part 4)

Section	Evaluated Component	B	N	I	IN
A	Confined/Unconfined Groundwater Levels				
B	Instream Flows				
C	Drain Flows				
D	Herbicide/Pesticide Use				
E	Wind/Water Soil Erosion				
TOTALS					

Indirect Economic Effects Summary Table (from Part 4)

Section	Evaluated Component	B	N	I	IN
B	Farm Inputs				
C	Local Farm Labor				
D	Processing of Farm Produce				

TOTALS					

Reservoir Lining Economic Analysis (from Part 5)

Enter Water Supplier B/C Ratio	

Reservoir Lining Financial Analysis (from Part 6)

	Yes	**No**
Can adequate funding be expected to be made available?		

	Yes	**No**
Is Reservoir Lining accepted?		

Please provide here and in the plan a discussion of why reservoir lining is accepted or rejected for implementation. Please include a discussion of estimated water savings, environmental effects, third-party effects , etc. for reservoir lining.